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SECTION 28

STANDARDS IN ELECTROTECHNOLOGY, TELECOMMUNICATIONS, AND INFORMATION TECHNOLOGY

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28.1 INTRODUCTION

Standards are documents on which agreement has been reached, normally by consensus, that contain specifications or criteria to be used to ensure that materials, products, processes, tests, or services are suitable for their intended purpose.

Standards apply to virtually everything in the world today. The average person is not even aware of their existence, but life would not be the same without them. Engineers, computer scientists, and other scientists, however, are acutely aware of standards and their impact on the work they perform. Development of many of the original standards associated with electrotechnology was a slow process. The products, tests, or specifications being standardized were often in use in industry and had, in reality, become *de facto* standards before the standards that referred to them were written and approved. In general, most of the standards written were not mandatory, and it was voluntary for users to apply them. In some instances, these voluntary standards became part of government regulations, were adopted by government agencies, or were mandated by companies in specifications. When these types of events occurred, compliance with a specific standard became mandatory. Early standards also became regional to varying degrees. For example, the United States had its electric power standards and European countries had their own electric power standards. Although the two sets of standards had many similarities, there were significant differences between them. Overall,

although there were some complaints, the standards development processes remained slow and the differences between standards continued to exist.

The 1980s brought some dramatic changes. The deregulation of the telephone industry, the privatization of government-run electric and telecommunication organizations, the birth of the information age, and the realization of a global market created a huge demand for standards in the fields of telecommunications and information technology. The Internet has, by itself, created the need for standards that govern its use, domain registration, and so forth. Many new players have entered the standards arena and found the traditional methods for developing standards unacceptable, primarily because they were too slow and bureaucratic. New standards in telecommunications and information technology were needed immediately, and the affected industries were moving so fast that many of the standards developed using traditional methods were obsolete before they were issued. Standards developers responded by streamlining processes and adopting fast-track systems. Even these proved too slow for some, and standards saw the birth of consortia whose charters included standards development. The global economy also caused people to take a hard look at existing regional standards. The differences between the standards were viewed as potential “barriers to trade,” and harmonization efforts began to make these standards more widely accepted. For example, the United States and Canada are now attempting to harmonize their electrical wiring codes. The global market brought about another significant change in standards. In addition to the traditional standards that dealt with products, tests, and specifications, the protection of intellectual property (e.g., trademarks, inventions, and copyrights) became an important issue. Many standards developers have already begun to make their standards available on the Internet for a fee, although grassroots initiatives have continued to allow free access to standards via the Internet.

Many consortia make their standards and specifications available at no charge. A few standards development organizations have also initiated programs that allow access to a limited number of standards without fee (e.g., the IEEE’s “Get 802” program).

28.2 HISTORY OF ELECTRICAL STANDARDS

Early History. The early history of electrical standards stems from activities dominated by the American Institute of Electrical Engineers (AIEE).^{*} In 1884, the institute began actively to develop standard specifications for the growing electrical industry. In 1890, it proposed that the practical unit of self-induction be named the henry. At the same time, the institute appointed its first committee on standardization—the Committee on Units and Standards. The members of this committee were A. E. Kennelly, chairman, F. B. Crocker, W. E. Geyer, G. A. Hamilton, and G. B. Prescott, Jr. The institute also appointed a “Standard Wiring Table Committee” under the chairmanship of E. B. Crocker, to assign linear resistance of standard-conductivity copper wire and at standard temperatures.

A committee was also appointed to prepare a program for the delegates to the International Electrical Congress, held in Chicago in 1893, in regard to units, standards, and nomenclature. As a result of the congress, there were adopted units for magnetomotive force (gilbert), flux (weber), reluctance (oersted), and flux density (gauss). Subsequently, as a result of correspondence with engineering organizations in England, France, and Germany, the term *inductance* was adopted to represent the coefficient of induction (with the symbol *L*) and the present definition of the term *reactance* was proposed by Steinmetz and adopted.

First Electrical Standards. In 1896, a “National Conference of Standard Electrical Rules” was held. The institute’s delegate, Professor F. B. Crocker, was made its president, and in cooperation with other national organizations, the conference promulgated the “Underwriters’ Rules,” which finally resulted in the *National Electrical Code*® (NEC®).^{**}

^{*}In 1963, the AIEE merged with the Institute of Radio Engineers to form the IEEE.

^{**}*National Electrical Code* and NEC are registered trademarks of the *National Fire Protection Association (NFPA)*.

In 1897, the Units and Standards Committee recommended adoption of the standard of luminous intensity, or candlepower, as the output of the amylacetate Hefner-Alteneck lamp. It also recommended that the Lummer-Brodhun photometer screen be adopted for measuring the mean horizontal intensity of incandescent lamps.

At the beginning of 1898, a discussion was organized on the subject of “standardization of generators, motors, and transformers.” This resulted in the formation of the first AIEE product standards committee, which in 1899 published the first electrical standard under the unique title *Report of the Committee on Standardization*.

National Institute of Standards and Technology. The AIEE was a prime mover in the endorsement of a bill before the U.S. Congress, in 1901, for establishing a national standardizing bureau in Washington, DC, “for the construction, custody, and comparison of standards used in scientific and technical work.” This bureau became known as the National Bureau of Standards (NBS) and has had a marked influence on the growth of U.S. technology. In 1988, the mission of the NBS was broadened by The Omnibus Trade and Competitiveness Act and other legislation, to help enhance competitiveness of U.S. industry and speed up the commercialization of new technology. At that time, the NBS was renamed the National Institute of Standards and Technology (NIST).

International Electrical Standards. In 1904, an International Electrical Congress was held in St. Louis which set a precedent for international congresses related to electrical units and standards. The congress unanimously recommended the establishment of two committees. Committee 1 consisted of government representatives and was responsible for legal maintenance of units and standards. This committee has now evolved into the International Conference on Weights and Measures (GPMU). Committee 2, of which Lord Kelvin was elected president, was responsible for standards related to commercial products in the electrical industry and became the International Electrotechnical Commission (IEC) in 1906.

Another international body, the International Commission on Illumination [Commission International de l’Eclairage (CIE)], had its first meeting in 1913. The CIE establishes international units, standards, and nomenclature, in the science and technology of light and illumination.

International Telecommunications Standards. In 1865 the first International Telegraph Convention was signed by 20 countries. This marked the formation of the International Telegraph Union (ITU). After the invention of the telephone in 1876 and wireless telegraphy (the first type of radiocommunication) in 1896, the scope of the ITU was broadened to include these new technologies. In 1906, the first International Radiotelegraph Convention was signed. The International Telephone Consultative Committee (CCIF) was formed in 1924, and the International Telegraph Consultative Committee (CCIT) was formed in 1925. In 1920 sound broadcasting began, and in 1927 the International Radio Consultative Committee (CCIR) was formed. At the Madrid Conference in 1932, the previous conventions were combined into the International Telecommunication Convention. The ITU changed its name in 1934, to the International Telecommunication Union. After World War II, the ITU became a specialized agency of the United Nations in October 1947. In 1956, the CCIF and CCIT merged to form the International Telephone and Telegraph Consultative Committee (CCITT). The year 1963 saw the first telecommunications satellite and the ITU set up a study group on space communications. Most recently, the Plenipotentiary Conference held in 1992 has remodeled the ITU to meet the challenges of the future.

International Standards Outside the Electrical Field. The original standards work in the fields outside electrotechnology was performed under the International Federation of the National Standardizing Associations (ISA), which was formed in 1926. ISA’s activities ended in 1942 as a result of World War II. In 1947, the International Organization for Standardization (ISO) was established, as a result of a meeting of delegates from 25 countries that was held in London in 1946. Like the IEC, the ISO is a nongovernmental organization that promotes the development of international standardization and related activities. Its areas of responsibility are fields outside electrotechnology, light, and telecommunications.

International Information Technology (IT) Standards. When the need for international standards in the field of information technology arose, it was clear that both the IEC and the ISO needed to be involved. In 1987, an agreement between the IEC and the ISO created the Joint Technical Committee on Information Technology (JTC-1). The ITU provides input to JTC-1 as an official liaison.

Another organization, The Internet Society (ISOC), was formed in 1992. Its formation came as a result of the INET Conference held in Copenhagen in 1991, where it was decided that a neutral and internationally recognized body devoted to the support of Internet administrative infrastructure was needed.

National Standardization. Although an international standards organization for electrotechnology existed, representation on the IEC was by national committees from its member countries. Many of these countries had their own national standards organizations responsible for their national standards program, endorsement of national standards, participation in international standards development, and so forth. A number of these national organizations later became founding members of the ISO.

In the United States, five professional engineering societies and three government agencies spearheaded by the AIEE organized the American Engineering Standards Committee (AESC) in 1918. The AESC has been aptly described as a “national clearinghouse for industrial standardization.” In its early years, this body was organized with 12 divisions, each based on its own area of technology. Few of these became active. The electrical engineering division actually became the strongest, even to the point of having its own bylaws. Today, the AESC is known as the American National Standards Institute (ANSI); however, at times during its history it was also known as the American Standards Association (ASA) and the United States of America Standards Institute (USASI). In 1926, under the auspices of the ASA, engineering abbreviations and symbols were standardized. The AIEE, in cooperation with ASA, sponsored in 1928 the development of a glossary of terms used in electrical engineering. This work was coordinated with the IEC*. Over the years, ANSI (and its predecessors) has had many responsibilities in the standards arena, including development of standards. Although many people still believe ANSI develops standards, it has not done so for many years. Standards that become American National Standards (ANSs) are written by one of more than 270 standards developers that can submit their completed standards to ANSI for acceptance as ANSs. It is interesting to note that, in the electrical industry, basic standardization was first in order of development, dating back before 1890. Technical standardization came next, with the formation of the Standards Committee of the AIEE in 1898. Manufacturing standardization came only as a result of World War I and did not take effect until 1920.

In Canada, the Canadian Standards Association (CSA) was formed in 1919. It is a not-for-profit organization supported by its members and develops standards in many fields. In 1970, a new organization called the Standards Council of Canada (SCC) was established by an act of parliament to coordinate voluntary standardization in Canada. The SCC is a federal Crown Corporation. The CSA represents Canada on a number of ISO Committees on behalf of the SCC. Standards may be submitted by accredited standards developing organizations to the SCC for approval as a National Standard of Canada.

Regional Standardization. Once standards began to be developed, it did not take long for regional organizations such as the Organization of American States (OAS), the Pan American Standards Commission (COPANT), or the Pacific Area Standards Congress (PASC), and alliances such as the North American Treaty Organization (NATO), to see the value in having common (or harmonized) standards. For example, in May 1923, the OAS (then known as American States of the Pan-American Union) established the Inter-American Electrical Communication Commission (now known as the Inter-American Telecommunication Commission). However, it was not until the formation of three regional standards organizations by the European Economic Community that the world really took notice. In the area of electrotechnology, the European Committee for Electrotechnical

*The 6th edition of the IEC Multilingual Dictionary was published in 2005, with over 19,400 definitions in English and French. Equivalent terms wherever available are included in up to 11 additional languages, including Arabic, Chinese, Dutch, German, Italian, Japanese, Polish, Portuguese, Russian, Spanish, and Swedish.

Standardization (CENELEC) was formed in 1973. Telecommunications standardization is the responsibility of the European Telecommunications Standard Institute (ETSI). All other standardization is the responsibility of the European Committee for Standardization (CEN).

Associations. Many associations have come to exist for various reasons, which may include standards. One of the earliest was the Association of Edison Illuminating Companies (AEIC). It was founded in 1885 to provide guidance to the Edison Illuminating companies that were being formed around the United States. The AEIC became a place where problems facing the growing electric utility industry could be solved by pooling the knowledge and experience of managers, engineers, and operators. Most of the work of the AEIC was technical in nature until 1948; however, in 1948 a committee was formed to deal with load forecasting and end-use management. The AEIC today continues to produce standards for equipment, such as cable, used by electric utilities.

Another example of an early association was Aeronautical Radio, Inc. (ARINC), formed in 1929 by four major airlines. ARINC was incorporated to serve as "the single licensee and coordinator of radio communication outside of the [U.S.] government." Once ARINC was organized, the Federal Radio Commission (predecessor of the Federal Communications Commission), transferred responsibility for all aeronautical ground radio stations to ARINC. ARINC continues to provide services today to the airlines, aviation-related companies, and government agencies.

In the field of telecommunications, the Exchange Carriers Association was formed in 1983 as part of the breakup of the Bell System (i.e., AT&T) in the United States. It has recently been renamed the Alliance for Telecommunications Industry Solutions (ATIS). Its membership is open to those involved in telecommunications in North America and the Caribbean. Committee T1 was formed in 1984 to give exchange carriers a voice in the creation of telecommunication standards, which had previously been developed, de facto, by AT&T. ATIS eventually became the secretariat for committee T1; however, committee T1 was retired in 2004 and its standards work was assumed by ATIS.

Standards in Current Times. The information age and global economy have increased the demand for new standards that are internationally acceptable. The completion of the Uruguay Round of negotiations (1986–1994) of the General Agreement on Tariffs and Trade (GATT) led to the establishment of the World Trade Organization (WTO) in 1995 and a new set of agreements covering goods, services, and intellectual property. It also established a new dispute settlement mechanism. The WTO is the only international agency overseeing the rules of international trade with 148 member nations (as of October 2004). In 2001, the WTO began to host a new round of negotiations under the Doha Development Agency. The formation of the European Commission (EC) along with its regional entities and requirements for compliance with European Norms has had a significant impact on standards. For example, in 1990 the European Organization for Certification and Testing (EOTC) was created under a memorandum of understanding between CEN, CENELEC and the European Free Trade Agreement (EFTA) countries. EOTC was formed to promote the mutual recognition of test results, certification procedures, and so forth throughout the EC and EFTA countries. The North American Free Trade Agreement (NAFTA) and EFTA have had similar effects on the standards community.

Programs intended to harmonize standards to make them more internationally acceptable were instituted by many standards developers. Certification (or registration) began to take on additional importance to those organizations that wanted to compete in the global market. As a result, conformity assessment (which includes both registration and certification) programs began to expand, and in a number of instances certification organizations in one country expanded into other countries or partnered with a certification organization in another country. In 1979, ISO established a technical committee to harmonize the increasing international activity in quality management and quality assurance standards. One product of this committee was the ISO 9000 series of standards, which are internationally accepted and can provide a company that uses them with a route to the world markets. After ISO 9000 the ISO 14000 series of standards on environmental management tools and systems were developed. These standards address a company's system for managing its day-to-day operations as they impact the environment.

Other changes that have occurred in the standards development arena are that the standards developers themselves are changing. Many have been renamed to reflect a more international flavor, and

most have reengineered their processes to provide standards in a more timely manner or have begun to introduce new products such as emerging technology standards. For example, the IEC introduced the Industry Technical Agreement (ITA) as a new product in 1997 “in its drive to remain relevant in the field of electrotechnology.” The ITAs are not produced within the traditional IEC committee structure, nor are they consensus documents; however, they can be produced in months rather than years. Later, the Technology Trend Assessment (TTA) was introduced. A TTA presents the state-of-the-art or trend in a field of emerging technology that might become an area for standardization in the near-to-medium-term. TTAs are typically the result of research or prestandardization work. Although these programs have met with some degree of success, those in the information technology and telecommunications market want standards in place before, not after, their products are created. These industries are more interested in the anticipatory information provided by the standards process than they are in the final standard. They are also interested in new and more flexible forms of standards development.

As a result, these industries have turned to the formation of trade associations and consortia to develop their standards. In the United States, the number of standards produced in this manner will be greater than those produced by traditional SDOs. In contrast to traditional standards which are typically produced by volunteers, trade associations and consortia use paid professionals and provide them with budgets for expenses, research, legal advice, and so forth. Additionally, international standards organizations such as IEC and ISO have recognized a number of these standards as Publicly Available Specifications (PASs). One example of an industry consortium is the World Wide Web Consortium (W3C). It was founded in 1994 and its mission is “to lead the World Wide Web to its full potential by developing protocols and guidelines that ensure long-term growth for the web.

Other examples are: the Unicode Consortium, established in 1991, to bring together leading software corporations and researchers at the leading edge of standardizing international character encoding; the Open Group, established to answer questions in IT that corporate IT users need answers to by aiding in the development and implementation of a secure and reliable IT infrastructure; the DSDM Consortium, established in 1994 to develop and promote a public-domain rapid application development method; and the Northeast American Electric Reliability Council (NERC), founded in 1968 after the Northeast Blackout to promote reliability of the electrical supply for North America.

28.3 STANDARDS AND THE LAW

Voluntary Standards System. The word *standard* has a number of meanings, but in the context of trade or engineering, it refers to voluntary technical standards that are normally developed by a consensus of experts. Many standards set safety or performance requirements for products or services, for example, standards for workshoes for those involved in electrical work to be “nonconductive with a reinforced toe” for safety purposes. These standards are not normally developed by lawmakers, and because they are outside of the mandatory scope of laws, they are sometimes referred to as *voluntary standards*. In general, standards are developed under a voluntary system. To the extent that their adoption is also voluntary, there is less vulnerability to legal liability. However, many standards are made mandatory, either through reference in purchase specifications and contracts or through adoption by government bodies as regulatory documents. For example, in certain states it may be illegal for a person to drive (or ride as a passenger) a motorcycle without a helmet that meets the requirements of a specific standard. Under such circumstances compliance ceases to be voluntary and the effect of the document is to disqualify or limit the acceptability of certain products or services.

The ability of standards to limit acceptable suppliers is a potential danger of standards and the processes under which they are developed must minimize the possibility of discrimination against specific companies. One can begin to see that standards could be developed that contain absurd requirements that could act as a barrier to trade from a foreign nation, or within the same nation violate antitrust laws. Additionally, once a standard is written into the law, if the law simply states that compliance with standard xyz is required, then any revision to the standard (as occurs periodically) has the effect of amending the law.

Legality of Standards. The legality of standards activities is primarily affected by laws related to the fixing of prices, conspiracy in restraint of trade, and intellectual property. Throughout history, standards have been well-known barriers to trade as countries hide protectionism in the veil of an absurd standard. An example would be a standard written by a country that requires the use of a specific material available only in that country for a particular part of the product. Today, however, standards are covered by the GATT, the WTO, and other trade agreements such as NAFTA. The WTO supports the use of international standards developed under the auspices of international standards organization such as IEC and ISO. One reason for this is the belief that it is felt that the international development process will identify and exclude any documents that contain hidden trade barriers. From the users' perspective, certification to international standards should result in greater international acceptance for their product or service.

In the United States, the two key governmental agencies involved are the Federal Trade Commission (FTC) and the Department of Justice. In 1975, the FTC and the Justice Department held hearings on a number of abuses of standards development and certification activities. These abuses involved individuals involved in the standards process who attempted to use standards for market advantage or to deny competitors entrance into an established market. One conclusion of the hearings was that there needed to be some fundamental guidelines and practices that would ensure that the activities related to standards development would be "fair." Those fundamentals were due process, openness, balance, public notice, and the right to participate and appeal. These are the same basic principles that govern standards development around the world; however, they have, in many instances, been interpreted and reinterpreted to the point where they slow down the process. This, as stated earlier, has driven many away from the traditional standards organizations, especially in the areas of new technology.

Since standards activities involve meetings in which representatives of competing organizations make agreements that affect engineering and industrial practices (both of which have economic implications), such meetings must take place under conditions which are subject to carefully regulated procedures. Failing this, participants could be subject to charges of violation of antitrust or conspiracy statutes. Trade associations and consortia are particularly vulnerable in this respect, as meetings restricted to their membership involve participants who tend to be exclusively competitive manufacturers, whereas meetings of committees of professional societies involve technical personnel who are more apt to be representative of the total industry (both manufacturers and users), independent consultants, government personnel, educators, and scientists. Similarly, international standards committees are populated by experts from the national committees from the member countries. These persons individually represent the consensus of experts in their country when developing or voting on standards. However, the degree of liability of participants in standards development activities is virtually negligible when these activities are conducted under the auspices of, and under the strict rules of, an organization experienced in standards development, that is, an organization whose procedures are designed to promote fair and unprejudiced participation by all eligible parties.

Certification. The certification of a product provides additional assurance that a product is reasonably safe and reasonably suited for its intended function. Certification is particularly important for products that are purchased by the general public (i.e., consumers). Legal action against certifying organizations is rare; however, negligence in the certification process could cause a certifying organization to become exposed to a claim for liability.

Patents. The issue of patents as related to their use (or specification) in standards has become something that most standards developers have had to deal with, particularly for new technology standards. Most standards developers have patent policies that require disclosure of patents at the time a proposal for development of a standard is submitted. They further require disclosure at any time in the standards development process that it becomes known that a patent is applicable to a standard. Additionally, the patent holder is normally required to provide a letter stating that (1) the patentee will not enforce any of its present or future patent(s) whose use would be required to implement the proposed standard against any person or entity using the patent(s) to comply with the standard or (2) a license will be made available to all applicants without compensation or under reasonable

rates, with reasonable terms and conditions that are demonstrably free of any unfair discrimination. If these conditions are met, the patent may be included in the standard; however, the standards developer normally publishes a disclaimer in the standard making no claims as to the validity of the patent or the reasonableness of rates and/or terms and conditions of the license.

Personal Liability. An area of legal concern for participants in the standards generation or approval process is the question of legal liability. A typical situation deals with the case where an accident occurs under circumstances where potentially negligent parties demonstrate that they faithfully complied with the provisions of the applicable safety standards. The question here is one of the extent of liability of those who participated in the generation or adoption of the standard. A somewhat equivalent situation arises in product liability cases. Any such claim in a legal action turns on allegations of negligence in writing the standard. The general conclusion held by counsel is that members of voluntary standards committees operating under procedures that embody the fundamental principles of due process, openness, balance, public notice, and the right to participate and appeal are not likely to incur significant legal risks.

Some standards developers indemnify those persons who are members of the organization, provided the processes of the organization have been followed during the standards development process. Other standards developers require those participating on its standards writing groups to sign a statement attesting to the fact that they will follow the organization's procedures when participating in standards activities for the organization.

28.4 THE VOLUNTARY STANDARDS PROCESS

Voluntary Development of Standards. There are literally tens of thousands of experts in the fields of electrotechnology, telecommunications, and information technology who participate in standards development worldwide. It should be clear that it is the process by which the standards are developed that is of importance. The process should embody the fundamental principles; however, there are almost as many processes as there are standards developers. Although it would be impossible to describe them all in this section, the information age has made access for interested parties easier than ever before. Today, the World Wide Web allows direct access to a wealth of standards information. A listing of organizations (including their acronyms) and their websites, is provided at the end of this section to enable an interested party begin exploration of the "world of standards." Many of the websites contain the full text of the procedures followed by the standards developer. These can frequently be downloaded.

Although the development processes are designed to enable the broadest possible input to standards, duplicate standards, conflicts between standards, and other problems may exist. The resolution of these problems may be by the standards developers themselves, or by a national or international organization. For example, in the field of electric power cable, conflicts have arisen between standards developed by ASTM and IEEE that had to be resolved by the developers, or by ANSI where resolution was not achieved by the developers. In the case of duplicate standards in a voluntary system, the standard of choice will usually be decided by the market (i.e., the standard referenced by users will become the standard used). Complementary standards for a product are sometimes developed by two or more standards organizations, with each organization responsible for preparing standards within its area of expertise. For example, for power switchgear standards in the United States, IEEE develops those standards related to specifications and tests, while NEMA is responsible for those standards related to ratings. Occasionally, two or more organizations may develop a standard jointly; however, issues related to copyright and reproduction need to be agreed to by each organization before work begins. An example of this is standard IEEE/ASTM S10 which was jointly developed by IEEE and ASTM International and first published in 1976. This standard is intended to give authoritative information on SI and guidance on its application to U.S. citizens and industry. Its use became more important in 1988 when the U.S. Metric Conversion Act was

amended to designate “the metric system of measurement as the preferred system of weights and measures for U.S. trade and commerce.”

Approval of standards is normally by consensus, with the definition of what constitutes consensus defined by the developing organization’s procedures. What this means is that a standard may be made available to users once consensus is reached by the sponsor. A problem here is that some sponsors apply a more rigid interpretation of consensus than intended (some even try to attain unanimity), which ultimately delays the standard. In these instances, the sponsor is doing a disservice to the users that need the standard. Although the sponsor is responsible for the technical content of the standard, the standards developer often has some sort of authority (e.g., a standards board) that is responsible for ensuring the organization’s process has been followed. Approval by that authority is the final step in the process before publication. Here, too, interpretation of the process by the authority can cause standards to be returned to the sponsor, resulting in an unnecessary delay of the standard.

Another part of the process that has not been discussed is the maintenance of a standard once it is developed. All standards require periodic review to ensure that the information contained in them is current. Once reviewed, the standard may be reaffirmed (or confirmed), revised, or withdrawn. The standards developers also have the ability to administratively withdraw a standard if it has not been reviewed by its sponsor within some maximum period of time. For example, in the United States, the maximum time a standard can exist without being revised or reaffirmed is 10 years. The IEEE requires its standards to be reviewed every 5 years. The sponsor may request an extension of up to 5 years with an explanation (a 2-year extension is normally granted on request, without explanation). The standard is administratively withdrawn by IEEE after 5 years if no extension is requested and after 10 years with extensions. Internationally, both ISO and IEC require a review of their standards by the responsible Technical Committee (or Subcommittee) at least once every five years. The process for maintenance of standards developed by some consortia may be less than adequate and may be a future issue in standards. This is an area that traditional standards developers are targeting for new work (i.e., to provide standards maintenance services to consortia).

28.5 TERMINOLOGY IN STANDARDS

Standards Terms. The following comprises a partial list of terms used by participants in standards activities. Many of these terms have unique and specialized meaning when used in the context of standardization, and a brief definition is given for each as applied in this context. Some of the terms are specific to the processes of the IEC and are identified by an (IEC) at the end of the explanation of the term.

approval stage The point after the enquiry stage, at which the final-draft international standard (FDIS) is circulated to the National Committees for a 2-month voting period. If the FDIS is approved it is published, and if it is not approved it is referred back to committee for reconsideration (IEC).

balance The characteristic of a standards approving unit (committee, subcommittee, or working group) which assures that all classifications of interests are represented and that no single classification has a representation sufficiently large to enable it to unduly influence the resulting output.

balanced committee A committee so constituted as to maintain a balance among its members. Many committees are balanced among manufacturers, users, and general-interest classifications.

basic standard A standard common to all disciplines, or to an overall technology.

canvass A method used for approval of standards which is dependent on circulation of a draft document to a list of concerned organizations for review and ballot.

*American National Standard for use of the International System of Units (SI): The Modern Metric System.

certification An attestation to the effect that a particular product or service meets the requirements of a relevant standard.

certification mark A special kind of trademark that appears *only* on products that have been certified against a standard.

classification of membership The classification assigned to a participant or member of a standards developing unit which identifies the member's functional relationship or interest in the subject to be standardized. Thus a participant may be a manufacturer of a product being standardized, a user or purchaser of the product, a technically qualified expert with no well-defined functional relationship (classified as general-interest), a labor or insurance representative (in the case of safety standards), or a constructor (one who installs the product for use by others). A variety of other classifications is possible as dictated by the scope of the standards activity.

code (a) A body of recommendations of good practice to be followed during design, manufacture, construction, installation, operation, and maintenance to satisfy considerations of safety, quality, economy, or performance in a given application. (b) A particular form of identification marking or reference which serves the dual purpose of establishing in a systematic manner the complete identity of an individual product and of identifying its similarity with other products. It may consist of a brief, systematic combination of letters, numerals, and symbols.

committee stage The point at which the document is submitted to the National Committees for comment and ballot if the document is intended to be published as a technical report (IEC).

conformity assessment An activity or set of activities that determines directly or indirectly whether relevant local product requirements have been fulfilled. Typical forms of conformity assessment include testing, inspection, assessment, auditing, certification, registration, and certification.

consensus A substantial agreement of those concerned. It implies that no important interested parties are strongly opposed on substantive grounds, or alternatively, that any opposition is in a small minority and the changes required to effect agreement by this minority would lead to substantive disagreement by the majority. Consensus implies that all disagreements have been given careful consideration and all reasonable attempts have been made for their resolution.

designation A definite and distinguishing name or symbol given to a product or to a group of functionally similar products or to an abstract matter. It emphasizes the group similarity but does not bring out the differences among the various members of the group.

dimensional interchangeability A condition in which the dimensions of two or more products are such that one can physically replace another in a given application.

dimensional standard A standard whose main content is dimensions and sizes of a product or group of products.

e.ballot A "letter ballot" or equivalent that is conducted electronically (e.g., via e-mail).

enquiry stage A point before the approval stage where the bilingual Committee Draft for Vote (CDV) is submitted to P-members of a technical committee for a 5-month voting period. It is the last stage at which technical comments can be taken into consideration (IEC).

functional interchangeability A condition where the characteristics of two or more products are such that they are able to perform the same functions.

guide A standards document that provides alternative information which comprises good engineering practice. Guides may contain application information for use of products and may be tutorial in nature. The user should be cautioned that the use of the word "guide" in the title of a document does not guarantee that the document is in fact nonmandatory. There are many governmental regulatory guides which in fact set forth mandatory requirements. Conversely, many documents that are differently titled are in fact guides.

harmonization The act of coordinating requirements from multiple standards (e.g., multiple countries or multiple SDO's standards) and copublishing the resulting document.

harmonization committee (or task force) A group of individuals responsible for technically developing the proposed draft of the harmonized standard. The group typically consists of a representative of each involved country (or SDO), the secretariat, the chair.

interface standard A standard whose main purpose is to ensure coordination between systems.

international standard A standard that has been adopted by a recognized international standards body (such as IEC or ISO).

joint publication A standard that has been submitted through the standards development process of two or more SDOs and is published separately by all involved SDOs. A joint publication may also be referred to as a harmonized or copublished standard, or if the SDOs represent different countries, as a binational or trinational standard.

letter ballot A ballot used in standards development to determine agreement on a draft standard, or to generate comments that will be instrumental in developing a document on which consensus agreement can be achieved. Such ballots provide for affirmative and negative votes. Negative votes, however, must be accompanied by reasons in sufficient detail to enable the writers of the document to determine what steps need be taken in revision to change the vote from negative to affirmative. The primary advantage of a letter ballot is that it provides adequate time for the recipients to review thoroughly the document which is subject to ballot.

marking The action and the result of stamping, inscribing, printing, or labeling marks, symbols, letters, or numerals on a product or its package for the purposes of identifying the product.

may An operative verb used in a standards document which identifies a possible means for satisfying a requirement. For example, several alternative procedures may be indicated for measuring a particular characteristic or phenomenon, and the selection of the most suitable procedure is left to the user of the document.

national standard A standard that has been adopted by a recognized national standards body (such as ANSI), or a standard that is in effect recognized and used nationally in preference to other documents.

O-member An observer member of a technical committee who has the right, but not the obligation, to vote and attend meetings (IEC).

performance characteristic A characteristic of a product which determines the product's suitability for a specific application.

P-member A participating member of a technical committee who is obliged to attend meetings and vote on a draft international standard (DIS, IEC).

preliminary stage Projects envisaged for the future but not yet ripe for immediate development, or preliminary work, such as better definition of a project for new work, data collection, or round-robin tests necessary to develop standards, which is not part of the standardization process (IEC).

preparatory stage The phase during which a working draft (WD) of a document is prepared (IEC).

product standard A standard containing requirements to be met by a product or group of products, usually including, directly or by reference to other standards, all or some of the following elements: dimensions, performance characteristics, other characteristics, and test methods.

proposal stage A proposal for new work originated from industry via a National Committee, communicated to the members of a technical committee or subcommittee with a form. A simple majority vote takes place within 3 months; if the result is positive and five members agree to actively participate, it is included in the work program (IEC).

rating A characteristic of a product which is determined in an arbitrary, yet consistent, manner, based on the intended function of the product.

recommended practice A standards document that provides information on good engineering practice. Such documents may contain application information for use of products.

safety standard A standard whose primary purpose is to ensure the safety of people and property.

SDO Standards Developing Organization.

secretariat An organization that assumes the responsibility for providing administrative oversight of a standards committee's activities and assures compliance with all applicable procedures.

self-certification An attestation by a manufacturer or supplier of a product or service that it meets the requirements of a relevant standard.

shall An operative verb used in a standards document which indicates a mandatory requirement that must be specifically complied with for conformance to the document.

should An operative verb used in a standards document which indicates a problem area that must be resolved and specifies a requirement, compliance with which resolves the problem. In this sense, the verb "should" can be read as "shall." Alternatively, it is allowable under the document to use some other method which can be proved to resolve adequately the condition or problem area addressed. In some cases, it is also possible to demonstrate clearly that the condition or problem area addressed does not in fact exist, or apply to the product or circumstance in a specific instance.

simplification A form of standardization consisting of the reduction of the number of types of products within a definite range to that number which is adequate to meet prevailing needs at a given time.

specification A standards document that specifies all the characteristics and conditions to be met by a product or service to be supplied to the purchaser. Such a document may refer to other standards, selecting among the specific allowable options. A specification is intended to be a complete purchasing document.

sponsor The group (e.g., a technical committee) that assumes responsibility for the development and/or maintenance of a standard.

standard A documented agreement containing technical specifications or other precise criteria to be used consistently as rules, guidelines, or definitions of characteristics to ensure that materials, products, processes, and services are fit for their purpose.

standardization An activity aimed at an increase of order, giving solutions for recurring problems in the spheres of scientific, technological, and economic activity. Generally it consists of the processes of formulating, issuing, and implementing standards.

terminology standard A standard containing exclusively terms and their definitions.

test standard A standard containing test methods which may be combined with other requirements related to testing, such as sampling, use of statistical methods, and sequence of tests.

third-party certification An attestation by a recognized, technically qualified, independent organization that a product or service supplied by others meets the requirements of a relevant standard. Such certification may be based on inspections and tests conducted by the certifying organization, or on supervision, monitoring, or auditing by the organization of such tests which may be conducted by others. The tests may be performed by the manufacturer or supplier of the service or product while being witnessed or audited by the certifier.

trial-use A publication (standard, recommended practice, or guide) that is effective for not more than 2 years, during which time comments and criticisms from a broad constituency are sought. In the absence of comments during the trial-use period, the document is subject to automatic approval on recommendation of the sponsor.

unification A form of standardization in which two or more specifications are combined into one in such manner that the products obtained are interchangeable in use.

28.6 ISO 9000 AND ISO 14000 STANDARDS

ISO 9000 and ISO 14000 Overview. Unlike the vast majority of ISO standards which are highly specific, ISO 9000 and ISO 14000 are generic families of standards and guidelines relating to

management systems. When introduced in 1987 and 1997, ISO 9000 and ISO 14000, respectively, introduced standards to a much broader business community (i.e., beyond organizations in the field of engineering and science only) than did any standards published previously. ISO 9000 is concerned primarily with quality management systems, while ISO 14000 is concerned mostly with environmental management systems. In the context of the standards, *quality management* means what an organization does to conform to its customers' requirements; *environmental management* means what an organization does to minimize harmful effects on the environment caused by its activities. Neither standard is a product standard, and organizations such as law firms, consulting engineers, or standards developers can become ISO 9000–certified. The reason for this is that both ISO 9000 and ISO 14000 are concerned with the way an organization goes about its work (i.e., the process), rather than the direct result of the work (e.g., a product or a service). (For additional information visit the ANSI, ASQ, ISO, and NIST Websites listed at the end of this section.)

ISO 9000 History. In 1959, the U.S. Department of Defense (DoD) established a quality management program designated as MIL-Q-9858, which was later revised to MIL-Q-9858A. NATO essentially adopted the provisions of MIL-Q-9858A in 1968, and published them in Allied Quality Assurance Publication 1 (AQAP-1). In 1970, the U.K. Ministry of Defense adopted the provisions of AQAP-1 when it published its Management Programs Defence Standard DEF/STAN 05-8. In 1979, the British Standards Institution (BSI) developed the first commercial quality management system standard, BS 5750. It was from all of these documents, and BS 5750, in particular, that ISO created the ISO 9000 standards family of documents (the base standards of which are shown below).

When Countries Adopt ISO 9000. By 1992, the European Economic Community (EEC) and 56 countries had adopted ISO 9000. The EEC and other countries assigned numbers to the adopted ISO 9000 standards according to their own national standards numbering system. In the United States, the ISO 9000 series was adopted as ANSI/ASQ Q9000 in 1987. The ANSI/ASQ Q9000 series is essentially identical to the ISO 9000 series with the exception that the text incorporates customary American English language and spelling. Some other examples of adoption of the ISO 9000 series are the EEC as the European Norm (EN) 29000 series, the United Kingdom as BS 5750 Parts 0 to 3, Pakistan as PS 3000-3004 series, Tanzania as TZS 500-504, and China as GB/T 10300.1–10300.5.

Certification. ISO does not itself certify conformity to ISO 9000. This is done by independent certification bodies in different countries. There is also no “official” database of entities certified to ISO 9000.

ISO 9000. This standard, entitled *Quality Management Systems—Fundamentals and Vocabulary*, explains fundamental quality concepts. Additionally, it defines terms and provides guidance on selecting, using, and tailoring the standards in the series.

ISO 9001. This standard, entitled *Quality Management Systems—Requirements*, is the most comprehensive standard in the series. It addresses all the elements in design, development, and so on and provides requirements for quality planning.

ISO 9002. Superseded by the 2000 Edition of ISO 9001.

ISO 9003. Superseded by the 2000 Edition of ISO 9001.

ISO 9004. This standard, entitled *Quality Management Systems—Guidelines for Performance Improvements*, provides guidance for developing and implementing an internal quality system.

Since their introduction, the number of standards in the ISO 9000 and ISO 14000 families have grown to more than 40 documents. In 2004, ISO 90003 was introduced which addresses guidelines for the application of ISO 9001 to computer software.

28.7 INTERNATIONAL ORGANIZATIONS

The International Electrotechnical Commission (IEC). The IEC, a nongovernmental body located in Geneva, Switzerland, is the world organization that develops and publishes international standards for electrotechnology and related technology. Its membership is limited to countries. Today, the IEC membership consists of almost 66 participating countries, including all the world's major trading countries (see Table 28-1). Full membership in the IEC allows the country to participate in all international standardization activities. Participation of a country is by a national committee. Each national committee agrees to open access and balanced representation from all electrotechnical interests in its country (i.e., public and private). A country may also become an associate member, which allows for limited participation in the IEC. Associate members have observer status at all IEC meetings, but have no voting rights.

The mission of the IEC is to promote, through its members, international cooperation on all questions of electrotechnical standardization and related matters, such as the assessment of conformity to standards, in the fields of electricity, electronics, and related technologies, including magnetism and electromagnetics, electroacoustics, telecommunication, energy production and distribution, terminology and symbols, measurement and performance, dependability, design and development, safety, and the environment.

The work of the IEC is carried out by more than 10,000 experts worldwide who participate on more than 200 technical committees and subcommittees, and more than 700 working groups. All IEC publications are bilingual (English and French). Certain documents have also been translated into Spanish. The Russian Federation National Committee develops Russian-language editions of IEC documents. English, French and Russian are the three official languages of the IEC; however, in all bodies of the IEC other than the Council, discussions may be held in English and/or French, following agreement of the delegates. Standards developed by the IEC follow the procedures in the ISO/IEC Directives, published jointly by both organizations and administered by the Joint Technical Program Committee (JTPC). These directives are published in two parts. Part 1 covers the procedures

TABLE 28-1 Member Countries of the IEC

Argentina	Iceland*	Pakistan
Australia	India	Republic of the Philippines†
Austria	Indonesia	Poland
Belarus	Iran	Portugal
Belgium	Ireland	Romania
Bosnia & Herzegovina*	Israel	Russian Federation
Brazil	Italy	Saudi Arabia
Bulgaria	Japan	Serbia and Montenegro
Canada	Kazakhstan*	Singapore
China	Kenya	Slovakia
Colombia*	D.P.R. of Korea*	Slovenia
Croatia	Republic of Korea	South Africa
Cyprus*	Latvia*	Spain
Czech Republic	Lithuania*	Sweden
Denmark	Luxembourg	Switzerland
Egypt	Macedonia* (former Yugoslav Rep. of)	Thailand
Estonia*	Malaysia	Tunisia*
Finland	Malta*	Turkey
France	Mexico	Ukraine
Germany	Netherlands	United Kingdom
Greece	New Zealand	United States of America
Hungary	Norway	Vietnam*

*Associate member.

†Suspended 1-13-2003.

for the technical work. Part 2 covers drafting and presentation of international standards. These common procedures were adopted by ISO/IEC in recognition of the need to develop timely and cost-effective international standards. The joint ISO/IEC Committee JCT 1, Information Technology develops and maintains its own procedures. All of these procedures may be accessed on each organization's web site.

Figure 28-1 is an organization chart for the IEC. The Council, which is a "general assembly" of committees, is the supreme authority of the IEC and sets policy, financial objectives, and strategy. The Council delegates the management of all IEC work to the Council Board. The responsibility for standards and conformity assessment is assumed by the Standardization Management Board and Conformity Assessment Board, respectively. In the areas of standards and conformity assessment, the IEC works closely with other international organizations such as the ISO, WTO, and ITU. It also has relationships with governmental agencies and regional standardization organizations. For example, an agreement between IEC and CENELEC ratified in 1996, known as the Dresden Agreement, addresses common planning of new work and parallel IEC/CENELEC voting. Other standards organizations may interface with the IEC as liaisons. For example, the IEEE is recognized as a Class D liaison to the IEC.

International Organization for Standardization (ISO). Like the IEC, ISO is a nongovernmental body, located in Geneva, Switzerland, that is a worldwide federation of national standard bodies. ISO is the world's largest developer of standards, publishing approximately 12,000 documents. Its membership is limited to countries, and at present, some 146 countries are members of ISO. The member body of a country to ISO is the national body "most representative of standardization in its country," and only one body in each country can be admitted to membership in ISO. So, for example, ANSI is the ISO member from the United States, Standards Council of Canada is the ISO member from Canada, Standards Australia is the ISO member from Australia, and DIN is the ISO member from Germany. ISO has two other categories of membership for countries. The first is correspondent member, for countries which do not yet have a fully developed national standards activity; the second is subscriber member, for countries with very small economies.

ISO likes to think of its documents as international agreements that are published as international standards. Some might note an apparent inconsistency between the short form of the organization's name, specifically, ISO and its official title. That is because the short form of the name is not an acronym as many believe, but rather a word ISO derived from the Greek *isos* meaning equal. On this basis, the connection between "standard" and "equal" is easy to understand.

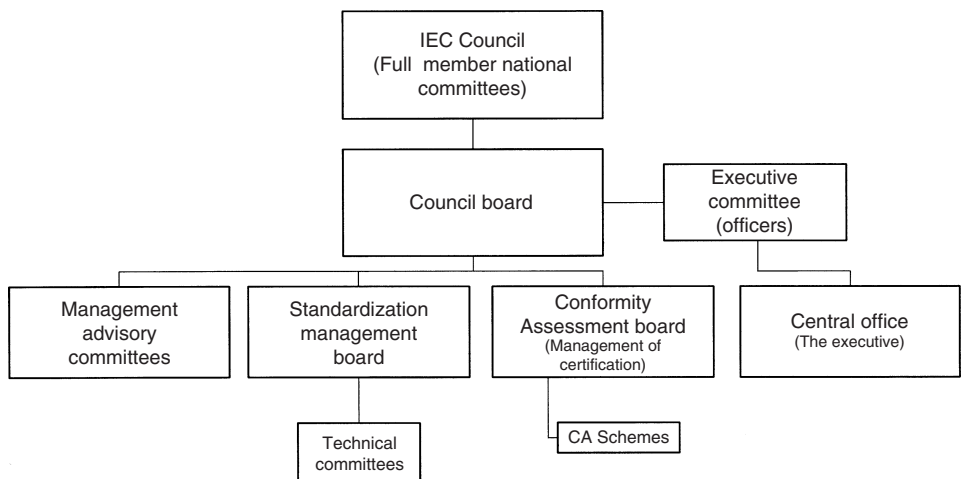


FIGURE 28-1 IEC structure and management.

The mission of ISO is “to promote the development and standards related activities in the world with a view to facilitating the international exchange of goods and services, and to developing cooperation in the spheres of intellectual, scientific, technology and economic activity.” The scope of ISO’s work is not limited to any particular field, except that electrotechnology is the responsibility of the IEC and information technology is carried out by JTC 1 (a joint committee of ISO/IEC).

Among the documents that affect those in electrotechnology that ISO is responsible for is the universal system of measurements, known as SI (Système International d’Unités) units, which are described in a series of 14 international standards. The work of ISO is carried out by more than 30,000 experts worldwide who participate on more than 700 technical committees and subcommittees, and more than 2000 working groups. An organization chart for ISO is shown in Fig. 28-2. ISO cooperates with other international bodies such as the IEC and ITU, with regional standardization organizations and is building a strategic partnership with the WTO. ISO also has liaisons with almost 550 entities worldwide that are interested in specific aspects of its standardization work. All ISO publications are bilingual (English and French) and are developed following the ISO/IEC directives.

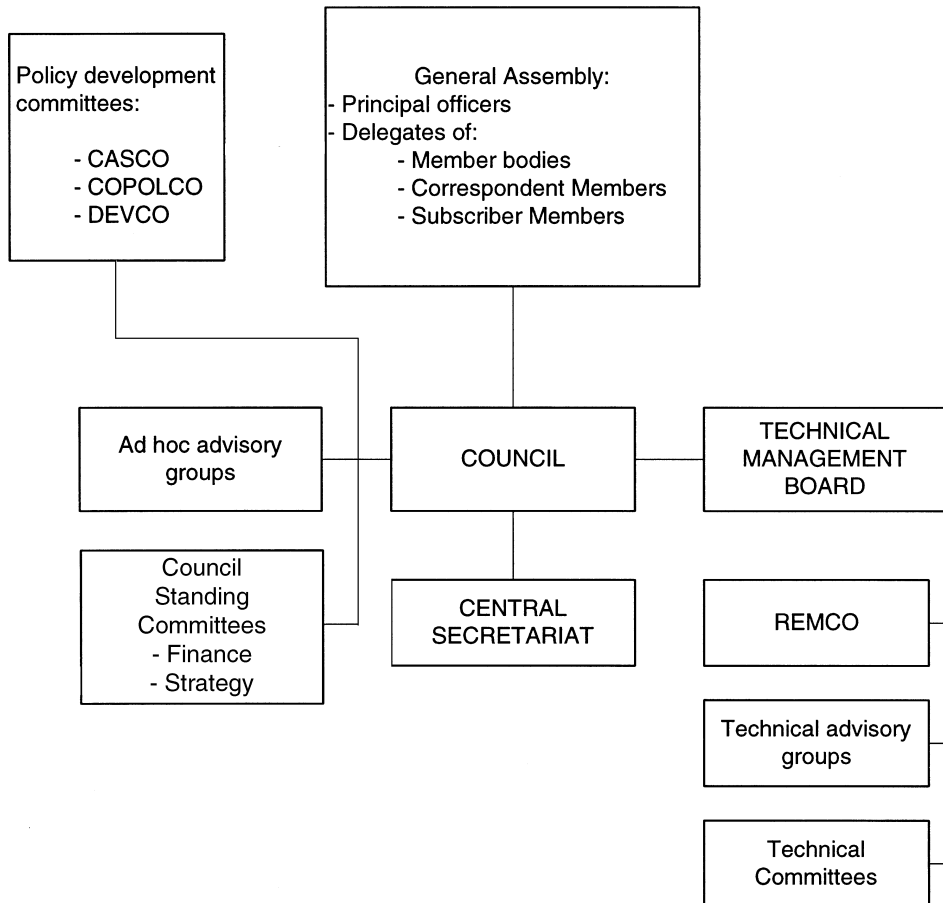


FIGURE 28-2 The ISO organization. (Legend: CASCO—Committee on Conformity Assessment; COPOLCO—Committee on Consumer Policy; DEVCO—Committee on Developing Country Matters; REMCO—Committee on Reference Materials.)

The International Telecommunication Union (ITU). The ITU, unlike the IEC and ISO, is part of the United Nations (UN), and its members are governments. It is located in Geneva, Switzerland and has 189 member states (i.e., countries). The ITU is an organization “within which governments and the private sector coordinate global telecom networks and services.” It is the leading publisher of telecommunication technology, regulatory, and standards information. The governing bodies of the ITU are shown in Fig. 28-3. The Plenipotentiary Conference has the responsibility to determine the structural and operating changes necessary in the ITU to effectively serve the requirements of the international telecommunications community.

Joint Technical Committee 1 on Information Technology (JTC 1). In recognition of the broad scope and applicability of international standards in the field of information technology, ISO and the IEC approved an agreement in 1987 that formed a joint committee, known as JTC 1 to carry out this work. Membership in JTC 1, like ISO and IEC, is limited to countries; its publications are bilingual (English and French). JTC 1 has 27 member countries (P-members) and 39 observer countries (O-members). It has 17 subcommittees that accomplish its work, and even though it is part of the ISO/IEC, it has its own Website.

The International Committee on Illumination (CIE). The CIE, located in Wien (Vienna), Austria, is “an organization devoted to international cooperation and exchange of information among its member countries on all matters relating to the art and science of lighting.” Its short form, CIE, is an acronym from its French title, Commission Internationale de l’Eclairage. The subjects covered by CIE in the fields of light and lighting include vision, photometry, colorimetry, application of light both indoors and out, environmental effects, aesthetic effects, and means for the production and control of light and radiation. The spectrum of light covered is both natural and synthetic over the ultra-violet, visible, and infrared regions. CIE also addresses the optical, visual, and metrological aspects of the processing and reproduction of images using all types of analogous and digital imaging devices, storage media and imaging media. Participation in CIE is like that of other international organizations, by national committee, with 38 countries represented at present. In addition to its own publications, the CIE has published standards jointly with IEC (e.g., the IEC/CIE International Lighting Vocabulary) and ISO.

The Internet Society (ISOC). The ISOC, located in Reston, Va. (U.S.A.), is a nonprofit, non-governmental, international professional membership organization. It was formed to provide an institution home for the Internet Standards process, as well as to provide financial support for the process.

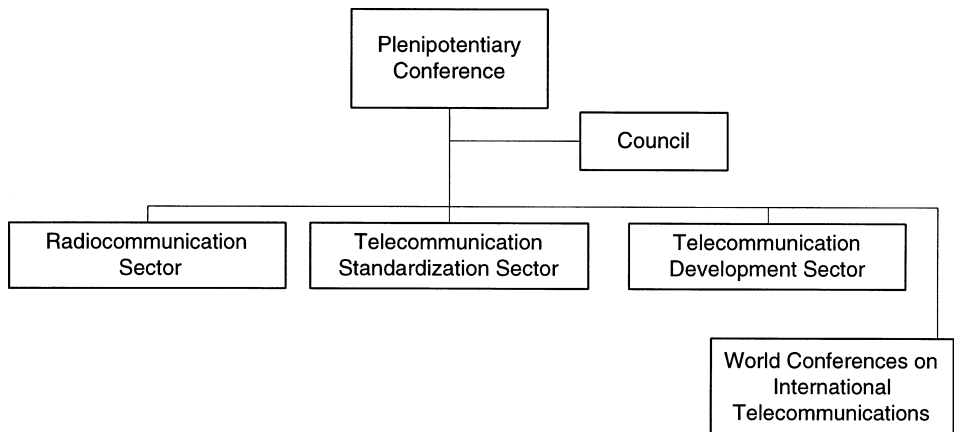


FIGURE 28-3 Governing bodies of the ITU.

It provides the leadership for addressing issues that affect the future of the Internet and it is the organizational home for the groups responsible for Internet infrastructure standards. The combined efforts of the ISOC and IETF have formed and maintain the foundation for all modern networks and Internet products and services. The primary organization supported is the Internet Engineering Task Force (IETF), which since its inception had been supported primarily from research supporting agencies of the U.S. government. The ISOC also charters the Internet Assigned Numbers Authority (IANA) as the central cleaning house to plan and coordinate unique parameter values for Internet protocols. Today, the ISOC has more than 100 organizational and 20,000 individual members in more than 180 countries.

The World Trade Organization (WTO). The WTO, located in Geneva, Switzerland, is an intergovernmental organization and is the only international organization involved in the rules of trade between nations. The WTO is a place where member governments can go to try and resolve trade problems that are between them. The main decision-making bodies are councils and committees consisting of the WTO's entire membership. The authority of the WTO comes from agreements, which are the legal ground rules for international trade and commerce policy. These agreements have three main objectives: "to help trade flow as freely as possible; to achieve further liberalization gradually through negotiation; and to set up an impartial means for settling disputes." Prior to the establishment of the WTO, the GATT had governed international trade and commerce since 1948. The GATT itself was initially an agreement that was provisional. It later became an international organization created to support the agreement but was not recognized in law as an international organization; however, the GATT (i.e., the agreement) has been incorporated into the WTO agreements. Unlike the GATT, which only dealt with trade in goods, the WTO agreements deal with other issues such as copyright, trademarks, patents, industrial designs, and trade secrets. Members of the WTO agree to use international standards (or harmonized standards) to minimize the risk of barriers to trade being introduced by standards. The WTO rules, however, sometimes support maintaining trade barriers when necessary such as in cases where there is a need to protect consumers or to prevent the spread of disease.

The World Intellectual Property Organization (WIPO). The WIPO, located in Geneva, Switzerland, is one of the United Nation's specialized agencies. As such, it is an intergovernmental agency, dedicated to "promoting the use and protection of works of the human spirit." It is responsible for "the promotion and protection of intellectual property throughout the world through cooperation among States, and for the administration of various multilateral treaties dealing with the legal and administrative aspects of intellectual property." The WIPO currently has 182 member states and administers 23 international treaties. Although the WIPO officially became part of the UN in 1974, its "roots" go back to 1883 when the Paris Convention for the Protection of Industrial Property was the first treaty designed to protect intellectual creations through patents and trademarks. Protection of copyrights was added in 1886 with the Bern Convention for the Protection of Literary and Artistic Works. These groups united in 1893 to form what became the WIPO in 1970.

28.8 REGIONAL ORGANIZATIONS*

European Committee for Electrotechnical Standardization (CENELEC). CENELEC, located in Brussels, Belgium, is a not-for-profit organization and has been officially recognized as the European Standards Organization in its field by the EC in Directive 83/189 EEC. Its membership is made up of national committees from 28 European countries. More than 40,000 technical experts are

**Author's note:* It is not possible, nor practical, to list all the regional and national organizations, and other standards organizations, that are involved with electrotechnology, telecommunications, and information technology standards. For those readers having additional interest, the World Wide Web provides one with an excellent means of researching these organizations. The reader is also referred to the listing of Websites at the end of this section.

involved in the development of its standards, which are called European Norms (ENs). ENs in the field of information technology are developed and published jointly with the European Commission for Standardization (CEN).

In developing standards, it is the policy of CENELEC to use an IEC standard if it exists (approximately 80% of CENELEC ENs have been developed in this manner). When new work is proposed, it is offered to the IEC with a request that it be undertaken at the international level. CENELEC will develop a standard only if the IEC does not want to undertake the work or if the IEC cannot meet the target dates for the standard. If the IEC assumes the development of a standard, parallel IEC/CENELEC procedures and voting (see Fig. 28-4) designed to result in identical international standards and ENs are used. Once CENELEC has begun work on a standard, or selected an IEC document, all national work (i.e., for CENELEC members) on the same subject is immediately stopped. This suspension of national work for CENELEC members is called “standstill.”

Voting in CENELEC is weighted according to the size of the country. Larger countries such as Germany, Italy, France, and the United Kingdom have 10 votes. The smaller countries have one or two votes depending on size. An affirmative vote must meet two conditions. First, a majority of the national committees must vote affirmative and second, at least 71% of the weighted votes must be affirmative. Once an EN is approved it is mandatory that it be adopted as a national standard by CENELEC members (this is unlike most standards processes, e.g., those of the IEC, which allow for

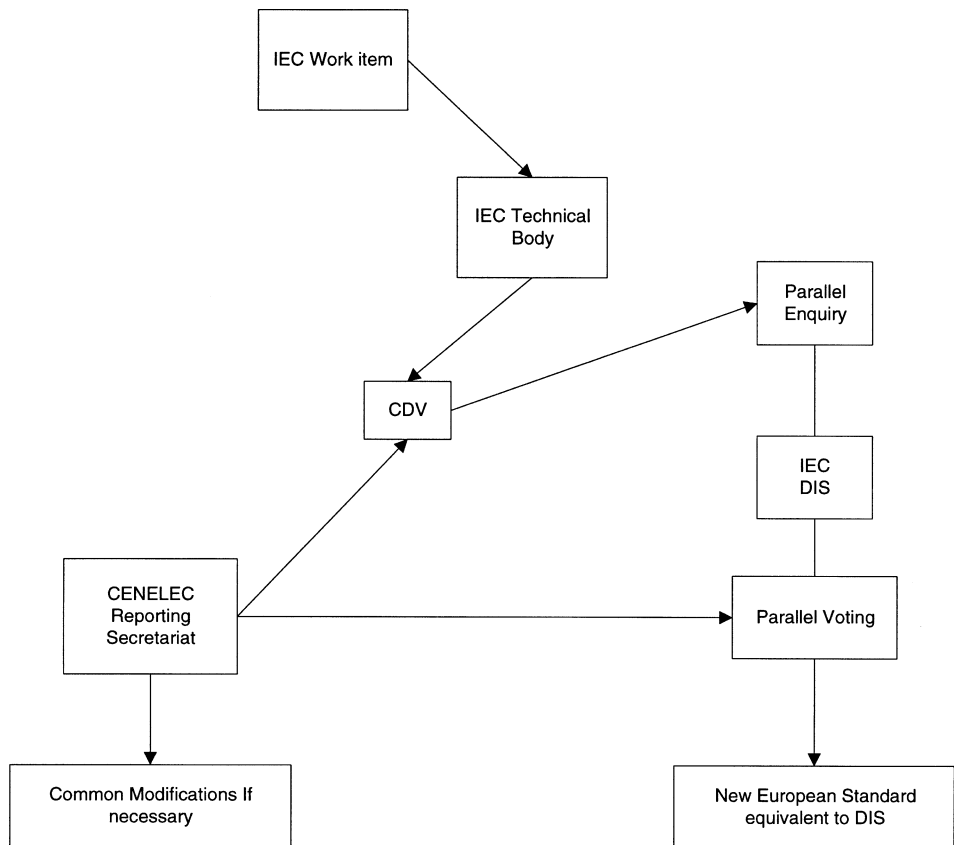


FIGURE 28-4 IEC/CENELEC parallel procedures for standards development. (Legend: CDV—Committee Draft with Vote; DIS—Draft International Standard; IEC—International Electrotechnical Commission.)

voluntary adoption). Each CENELEC member is also obligated to withdraw any of its national standards that conflict with an approved EN. On this basis, it is acceptable for a national committee to vote one way in CENELEC (e.g., negative) and another way in IEC (e.g., affirmative).

European Telecommunications Standards Institute (ETSI). ETSI, located in Sophia Antipolis, France, is a nonprofit organization whose mission is “to produce telecommunications standards for use today and the future.” It is an open forum (i.e., to European organizations) that brings together some 688 members from 55 countries, representing governments, network operators, manufacturers, service providers, and users. ETSI, unlike CEN and CENELEC, produces voluntary standards, some of which may be adopted by the EC as the technical base for directives or regulations. Promotion of international standardization is favored by ETSI, and as such, it coordinates its activities with international bodies (primarily with the ITU). At present, more than 3500 experts are working in more than 200 groups in ETSI, with more than 13,200 documents already published.

Voting on standards within ETSI is done according to its Rules of Procedure depending on the issue, with only those that are full and associate members allowed to vote. The voting method is weighted individual voting.

28.9 NATIONAL ORGANIZATIONS

The American National Standards Institute (ANSI). ANSI, headquartered in Washington, DC with its operation center located in New York City, is a federation founded in 1918 that has been the administrator and coordinator of the U.S. private-sector voluntary standardization for 88 years. It is a private, not-for-profit organization supported by a number of organizations (i.e., its membership) in the public and private sectors. Today ANSI has approximately 1000 members from companies, organizations, government agencies and institutions.

ANSI’s primary goal is “the enhancement of global competitiveness of U.S. business and the American quality of life by promoting and facilitating voluntary consensus standards and ensuring their integrity.” ANSI also “promotes the use of U.S. standards internationally, advocates U.S. policy and technical positions in international and regional standards organizations, and encourages the adoption of international standards as national standards where these needs meet the needs of the user country.” ANSI is the U.S. member of ISO and, via the United States National Committee (USNC), the IEC.

ANSI does not itself develop standards but functions, rather, as a coordinating body for the purpose of encouraging development and adoption of worthwhile standards as American National Standards. It looks to its organizational members, as well as to other concerned organizations, for accomplishing the task of standards development. These development activities may be performed wholly within one of these organizations, or in accredited committees organized and administered by one of these organizations and operating under a set of rules meeting the basic procedures of ANSI.

A large number of standards (more than 10,000 in 2002) that are processed for adoption by ANSI are developed, approved, and published by any of more than 270 standards development organizations accredited by ANSI. Organizations wishing to become ANSI accredited must develop and maintain procedures (subject to periodic audit by ANSI) that consistently adhere to a set of ANSI requirements or procedures entitled “ANSI Essential Requirements: Due Process Requirements for American National Standards*,” that govern the consensus development process. Three of the more commonly used methods are described below:

1. **Accredited organization method.** The organization method is most often used by associations and societies that have, among other activities, an interest in developing standards. Although participation on the consensus body is open to all interested parties, members of the consensus body often participate as members in the association or society. The organization’s procedures must

*Available for download from the ANSI Web site.

meet the general requirements of the ANSI procedures. By choosing to use this method, flexibility is provided, allowing the standards developer to utilize a system that accommodates its particular structure and practices.

2. *Accredited standards committee method.* Accredited standards committees are standing committees of directly and materially affected interests created for the purpose of developing a document and establishing consensus in support of this document for submittal to ANSI. The committee method is most often used when a standard affects a broad range of diverse interests or where multiple associations or societies with similar interests exist. The committee serves as a forum where many different interests, without a common membership in an organization or society, can be represented. Accredited standards committees are administered by a secretariat. An accredited standards committee develops and maintains its own operating procedures consistent with the requirements of the ANSI Procedures.
3. *Accredited canvass method.* A standards developer using the canvass method identifies, to the extent possible, those who are directly and materially affected by the activity in question and conducts a letter ballot or canvass of those interests to determine consensus on a document. Although canvass developers provide ANSI with internal procedures used in the development of the draft American National Standard, the due process used to determine consensus begins after the draft standard has been developed. Standards developers using the canvass method must use procedures consistent with the requirements of the ANSI procedures.

Figure 28-5 is an organization chart for ANSI. Standards work is under the Executive Standards Council (ExSC). The ExSC has responsibilities for American National Standards and U.S. participation in those international standards activities in which ANSI participates. ExSC is also responsible for maintaining ANSI procedures for standards development, development and coordination of U.S. position in international standards activities, and establishing and supervising such groups as needed to carry out these responsibilities. The approval and withdrawal of American National Standards has been delegated by the ExSC to the Board of Standards Review (BSR), one of the boards that report to the ExSC.

The Association for Electrical, Electronic and Information Technologies (VDE). VDE, located in Frankfurt am Main, Germany, is a nonprofit, nongovernmental organization founded in 1893 and is one of the largest technical and scientific organization in Europe with more than 33,000 members. In the area of standards in electrotechnology, VDE participates with The German Institute for Standardization (DIN) on the German Commission for Electrical, Electronic and Information Technologies of DIN and VDE (DKE), in both the IEC and CENELEC. The DKE is a joint organization of VDE and DIN; however, VDE is responsible for the administration of DKE. Approximately 4500 persons are involved in the standards process in more than 300 committees and subcommittees, and 300 working groups. The focus of standardization has shifted in the recent past toward the development of European Standards (based on international standards where possible). Pure national standards activity has dropped to approximately 5% of all work done.

VDE also performs certification and testing through the VDE Testing and Certification Institute, which was originally established in 1920 as the VDE Test Center. The VDE Testing and Certification Institute works together with other organizations, such as UL in the United States and CSA in Canada, in approximately 50 countries.

Standards Australia (SA). SA, located in Sydney, Australia, is an independent not-for-profit organization whose primary role is “to prepare Australian Standards through an open process of consultation and consensus in which all interested parties are invited to participate.” SA was originally founded in 1922, as the Commonwealth Engineering Standards Association. In 1929, it became the Standards Association of Australia and was granted a Royal Charter in 1950. Its name officially changed to Standards Australia in 1988. SA represents Australia on both the ISO and the IEC. It is also involved in regional standardization activities and was a founding member of the Pacific Area Standards Congress (PASC). It maintains close ties with Standards New Zealand (SNZ) and has a formal agreement with SNZ for developing and publishing joint standards.

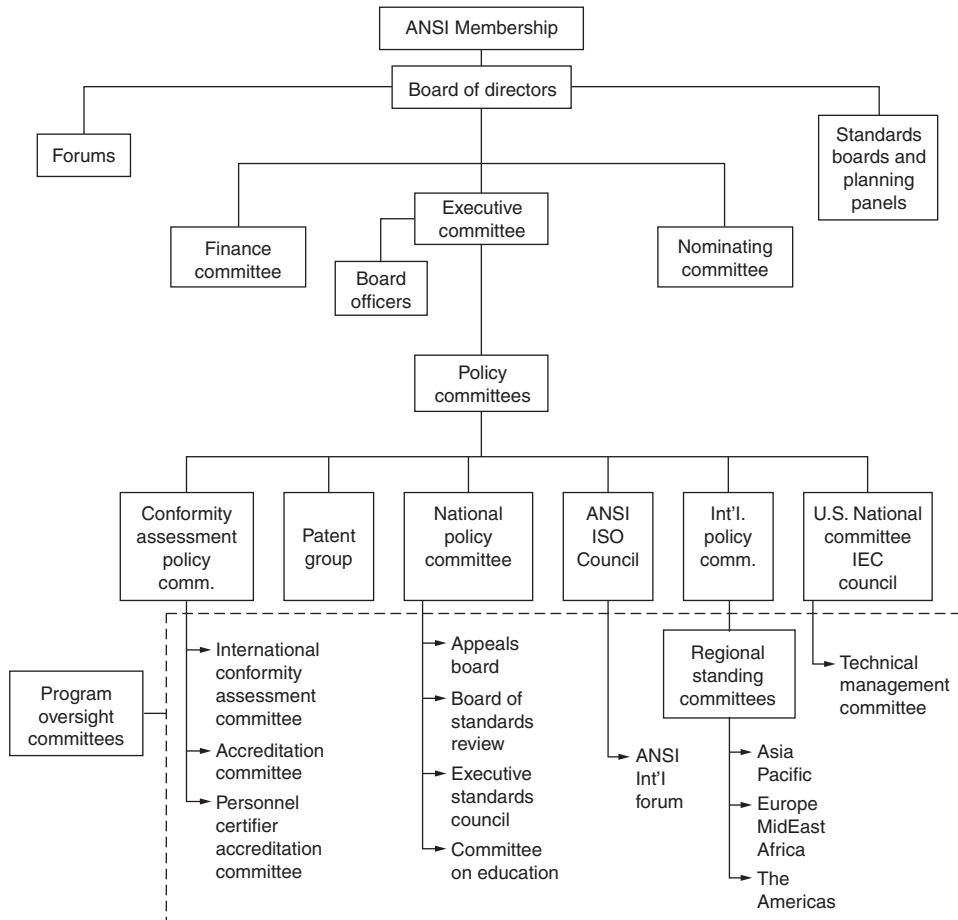


FIGURE 28-5 ANSI organization chart.

At present, approximately 9000 volunteer experts serve on 1500 committees that are responsible for the development and maintenance of approximately 6400 Australian Standards. SA has a subsidiary company, Quality Assurance Services Pty. Ltd., which provides system and product certification services.

Standards Council of Canada (SCC). The SCC, located in Ottawa, Canada, is a federal crown corporation with a mandate to “coordinate and oversee the efforts of the National Standards System, which includes organizations and individuals involved in voluntary standards development, promotion and implementation in Canada.” The SCC reports to Parliament through the Minister of Industry. The Governing Council of the SCC consists of 15 members representing a broad spectrum of stakeholder interests. The council is responsible for setting the strategic direction of the organization, ensuring the fulfillment of the SCC’s mandate and providing direction on governance matters. Canadian participation

in the ISO and the IEC operates under a program under the SCC. The SCC acts as the secretariat for the Canadian National Committee of the ISO (CNC/ISO) and the Canadian National Committee of the IEC (CNC/IEC).

There are more than 15,000 Canadian volunteers involved in standardization activities and some 400 organizations have been accredited by the SCC, as SDOs, certification organizations, testing and calibration, laboratories, registration organizations or auditor certifiers and trainers. Of these organizations, four have been accredited as SDOs. These are Bureau de normalization du Québec (BNQ), Canadian General Standards Board (CGSB), Canadian Standards Association (CSA), and Underwriters' Laboratories of Canada (ULC). These accredited SDOs may submit standards they develop to the SCC for approval as National Standards of Canada (NSC). To become an NSC, a standard must be developed by a process incorporating the fundamental principles, be subject to public scrutiny, be consistent with or incorporate appropriate international and national standards, and be available in the English and French languages. A NSC cannot in any way be presented in such a manner that it will act as a barrier to trade.

28.10 OTHER STANDARDS DEVELOPERS

The Institute of Electrical and Electronics Engineers—Standards Association (IEEE-SA). The IEEE-SA, located in Piscataway, N.J. (U.S.A.), has been responsible for all matters related to standards since its formation in 1998. Actually, the concept of the IEEE-SA was approved by the IEEE Board of Directors in 1996 as part of an overall restructuring of IEEE as it moved into the twenty-first century. Prior to 1998, the IEEE standards program was administered by a Standards Board that reported to the Board of Directors. Under the IEEE-SA, the Standards Board still exists; however, it reports to the IEEE-SA Board of Governors. Standards development in the IEEE, which is the world's largest professional society, with more than 365 000 members in 150 countries, goes back to 1884, when the AIEE began to develop standards. Even today, the IEEE publishes 25% of all of the world's literature in electrotechnology.

The IEEE-SA was formed "to provide a major entity that would offer increased responsiveness to the standards interests of IEEE societies and their represented industries." The IEEE-SA provides services and innovative standards development processes that will keep pace with the needs of users. New classes of membership in the IEEE-SA have been approved, such as corporate membership, which will assist the IEEE-SA in realizing its strategic objectives. At present, the IEEE-SA has more than 30,000 volunteers and more than 70 corporate members participating in its standards activities. The IEEE-SA develops standards in such diverse subjects as broadcasting and communications, electrical practices for large industry (mining, textiles, shipbuilding, transportation, cement plants, and others), instrumentation and measurement, insulators and insulation, magnetics, motors and generators, nuclear power, power apparatus and systems, recording, symbols and units, electrical transmission and distribution, medical devices, electrical practices for commercial buildings and hospitals, emergency power systems, stationary batteries, and information technology. The IEEE-SA also serves as secretariat for a number of accredited standards committees (ASCs), an example of which is ASC C2, the *National Electrical Safety Code*® (NESC®).*

The National Electrical Manufacturers Association (NEMA). NEMA, located in Rosslyn, Va. (U.S.A.), is responsible for the development and maintenance of over 500 standards. NEMA is the largest trade organization for manufacturers of electrical products in the United States, and its 400 member companies are domestic firms varying in size from small companies to large diversified companies. It develops standards in the technical committees of its nine divisions covering

**National Electrical Safety Code*® is a registered IEEE trademark, and its acronym, NESC® is a registered IEEE service mark of the IEEE.

products in such fields as building equipment, power electronics, industrial electrical equipment, insulation, lighting, power equipment, wire and cable, radiation imaging products, and industrial automation.

NEMA technical committees comprise engineers designated to represent member companies who are manufacturers of electrical equipment. Since manufacturers are most knowledgeable in the technology associated with their respective products, NEMA committees are highly competent in developing product standards that realistically take into consideration the economic tradeoffs that are essential to practical standardization. Standards are adopted by consensus with final approval given by the NEMA Codes and Standards Committee.

NEMA Standards are generated in four classifications:

1. NEMA Standard—defines a commercially standardized product subject to repetitive manufacture.
2. Suggested Standard for Future Design—suggests an approach to future product improvement or development.
3. Authorized Engineering Information—included as part of other NEMA standards to explain data or information.
4. Official Standards Proposal—proposed draft for adoption by some other organization such as ANSI.

NEMA is a member of and actively participates in ANSI. It administers the work of a number of ASCs, acting as the secretariat.

The National Fire Protection Association (NFPA).[†] The NFPA, located in Quincy, Mass. (U.S.A.), has been active in standards development since its founding in 1896. Working under the direction of its Standards Council, the technical committees of NFPA, composed of organization representatives, personal members, and liaison members from other technical committees, develop standards documents that are then subject to public review as a result of advance publication, and are finally approved at a semiannual meeting of the entire NFPA membership. Although dedicated to fire prevention, NFPA is responsible for a series of electrical standards, the most noted of which are the *National Electrical Code* (NFPA 70) and the *Life Safety Code* (NFPA 101).

The NEC covers “the installation of electric conductors and equipment in public and private buildings or other structures (including mobile homes, recreational vehicles, and floating buildings), industrial substations, and other premises (such as yards, carnivals, and parking lots). The NEC also covers installation of optical fiber cable.” The NEC is adopted and enforced in all the 50 U.S. states. It is also the basis for electrical codes in several other countries. For example, the Venezuelan electrical code is the 1981 edition of the NEC. The first edition of the NEC was published in 1897. The NFPA took over responsibility for the NEC in 1911. The NEC is produced and maintained by volunteers on 20 codemaking panels and an 11-member correlating committee that oversees the work of the panels.

The *Life Safety Code* “provides minimum requirements for the design, operation, and maintenance of buildings and other structures for safety to life from fire and similar emergencies.” The *Life Safety Code* has been adopted by many states. Additionally, all health-care facilities in the United States receiving Medicare or Medicaid funding must comply with the *Life Safety Code*. The groundwork for the *Life Safety Code* began in 1913, when the NFPA appointed its first “Committee on Safety to Life.” Its first pamphlet was on exit drills in factories, schools, department stores, and theaters. By 1921, the committee had produced a more comprehensive *Building Exit Code*. The *Life Safety Code* is produced and maintained by members of 15 technical committees.

[†]*National Electrical Code*®, *Life Safety Code*®, and NEC® are registered trademarks of NFPA.

Underwriters' Laboratories, Inc. (UL),^{††} UL, located in Northbrook, Ill. (U.S.A.) is the leading third-party certification organization in the United States and the largest in North America. It is an independent, not-for-profit organization, founded in 1894, whose mark is recognized throughout the world as a symbol of safety.

UL maintains and operates laboratories for testing devices, systems, and materials with relation to public safety. Products so tested and meeting its requirements are eligible for UL "listing." UL maintains an inspection and follow-up program in factories where UL-listed devices are manufactured. UL representatives conduct in-factory and in-the-field inspections of manufacturers' procedures for assuring production compliance with UL requirements. Such requirements appear in appropriate UL Standards for Safety which are developed by UL under procedures that involve consultation with industry and government experts and consumers, among others.

The majority of insurance underwriters in the United States, and many federal, state, and municipal authorities, either accept or require listing or classification by UL as a condition of their recognition of devices, systems, and materials having a bearing upon life and fire hazards.

UL is divided into several engineering departments, each dealing with distinct and separate subjects as follows: electrical heating, air conditioning, and refrigeration; casualty and chemical hazards; burglary protection and signaling; fire protection; and marine. Each department has prepared standards for systems, materials, and appliances.

UL publishes (lists) the names of companies who have demonstrated the ability to provide products conforming to its requirements. Listing authorizes the manufacturer to use the laboratories' listing mark (classification marking, recognition marking, or certificate) on the listed products. UL submits its standards to ANSI for adoption as American National Standards.

UL is active in international standards development and product certification, and is a registrar for quality systems for various systems, including ISO 9000. UL acquired the Danish National Testing and Certification Organization (DEMKO) in July 1996 from the kingdom of Denmark, making it a wholly owned subsidiary of UL. This acquisition provides direct European certification of products to customers worldwide.

UL is responsible for the development and maintenance of more than 800 safety standards, the evaluation of more than 17,000 products, and more than 2500 quality system registrations. In 1998, UL estimated that approximately 14 billion products enter the marketplace each year bearing a UL mark.

28.11 U.S. GOVERNMENT REGULATORY STANDARDS BODIES

The U.S. Consumer Products Safety Commission (CPSC). The CPSC is an independent federal regulatory agency that was created by Congress in 1972, in the Consumer Products Safety Act. The mission of the CPSC is to "protect the public against unreasonable risks of injuries and deaths associated with consumer products." The CPSC has jurisdiction over approximately 15,000 consumer products. Exceptions are motor vehicles, trucks, and motorcycles, which are covered by the Department of Transportation; foods, drugs, and cosmetics, which are covered by the Food and Drug Administration; and alcohol, tobacco, and firearms, which are covered by the Department of the Treasury.

The CPSC works to reduce the risk of death and injury to consumers by developing voluntary standards with industry, and issuing and enforcing mandatory standards. If no feasible standard would adequately protect the public, the CPSC can ban a product. It can also require a recall of products to arrange for their repair. The CPSC also conducts research on potential product hazards and sponsors consumer educational activities (e.g., through the media). All work related to standards or regulations are published in the *Federal Register*. Initially, notice of the proposed

^{††}Underwriters' Laboratories, Inc.[®] and its acronym, UL[®], are registered trademarks of Underwriters' Laboratories.

standards or regulation is published for comment. Final regulations are also published in the *Federal Register*.

The U.S. Environmental Protection Agency (EPA). The EPA is an independent federal agency created by Congress in 1970. Its mission is “to protect human health and to safeguard the natural environment—air, water, and land—upon which life depends.” The EPA develops regulations and has additional responsibilities for enforcement of these regulations.

The EPA, like other U.S. government agencies, follows a prescribed rulemaking process. The U.S. Congress establishes these requirements to support the development of quality rulemaking and protect the rights of those affected by the rules. Examples of these requirements include the Administrative Procedure Act, the Regulatory Flexibility Act, the Unfunded Mandates Reform Act, the Paperwork Reduction Act, and the National Technology Transfer and Advancement Act. The five stages of rulemaking are

1. *Prerulemaking*—actions to determine whether the agency should initiate rulemaking
2. *Proposed rules*
3. *Final rules*
4. *Long-term actions*—prerulemaking, proposed rule and final rules expected to be published beyond the next 12 months
5. *Completed actions*—actions that are promulgated and published or actions that are no longer being considered

Comments from interested parties are encouraged during the rulemaking process. All rulemaking activities are published in the *Federal Register*.

The U.S. Federal Communications Commission (FCC). The FCC is an independent U.S. government agency established in 1934 by Congress in the Communications Act of 1934. Its mission is “to regulate interstate and international communications by radio, television, wire, satellite and cable.” The FCC’s jurisdiction is the 50 states, the District of Columbia, and U.S. possessions. The FCC is organized in bureaus and offices, and the official statement of the FCC actions is called an *order*. Most of the FCC’s documents are issued by seven major regulatory bureaus or offices. When the FCC considers a change to its regulations, it issues a Notice of Proposed Rule Making. Essentially all documents issued by the FCC since 1994, can be found on-line through its website.

The U.S. Federal Trade Commission (FTC). The FTC enforces federal antitrust and consumer protection laws and seeks to ensure that the nation’s markets function competitively, and are vigorous, efficient, and free of undue restrictions. The FTC has enforcement and administrative responsibilities under 37 separate acts.

The U.S. Food and Drug Administration (FDA). The FDA is one of the oldest federal agencies involved with the protection of consumers. In the area of electrotechnology standards, it is involved with setting standards for medical devices and radiation-emitting products. This work is done under the FDA’s Center for Devices and Radiological Health (CDRH). The CDRH is responsible for “ensuring the safety and effectiveness of medical devices and eliminating unnecessary human exposure to man-made radiation from medical, occupational, and consumer products.” Products covered in the CDRH’s scope include thousands of medical devices (e.g., pacemakers), videodisplay terminals, microwave ovens, medical x-ray machines, and medical ultrasound devices.

National Institute of Standards and Technology (NIST). NIST, which is under the U.S. Department of Commerce, has been involved in the development of standards since its founding in

1901 (then known as the National Bureau of Standards). The documents it produced played a great role in the industrial development of the United States in a broad range of industries, including steel manufacturing, railroads, electric power, and telephone communications. Today it is involved in manufacturing partnerships, quality systems, measurement and testing laboratories, and advanced technology programs. In quality systems, it sponsors the Baldrige National Quality Program and the Malcolm Baldrige National Quality Award.

NIST also develops standards and guidelines for federal computer systems. These documents, known as *Federal Information Processing Standards* (FIPSS), are approved by the Secretary of Commerce. FIPSS are generally developed only when there are no acceptable industry standards available or there are compelling federal requirements (e.g., security). There are also Federal Standards (FED-STDS) developed for telecommunications; however, these are developed by the National Communications System (NCS) and are approved by the General Services Administration (GSA).

The major focus of NIST is on information technologies. Under the National Technology Transfer and Administration Act of 1995, NIST supports the development of national and international voluntary standards as the preferred source of standards for use by the federal government. NIST cooperates with national and international standards organizations, trade associations, consortia, user groups, and so forth to have needed standards developed.

The U.S. Nuclear Regulatory Commission (NRC). The NRC is an independent federal agency established by the Congress under the Energy Reorganization Act of 1974, to “ensure adequate protection of the public health and safety, the common defense and security, and the environment in the use of nuclear materials in the U.S.” Its predecessor was the U.S. Atomic Energy Commission. NRC regulations are issued under the U.S. *Code of Federal Regulations* (CFR) Title 10, Chapter 1. Typically, rulemaking is initiated by the NRC’s staff; however, any member of the public may petition the NRC to develop, modify, or rescind any regulation. During the rulemaking process, the documents are published in the *Federal Register* and interested parties are allowed at least one opportunity to comment. In some instances, the NRC will hold meetings and workshops before a proposed rule is drafted to obtain a broad range of input from interested parties. Most often in the area of electrotechnology, the NRC will endorse existing industry standards by issuing a regulatory guide (RG). The RG will describe methods that are acceptable to the NRC for applying the standard. The NRC may also use the RG to make recommendations or guides presented in a standard mandatory requirements. The NRC also issues NUREG reports to provide information and expertise to support the NRC’s decision making and to assess potential technical issues.

The U.S. Occupational Safety & Health Administration (OSHA). OSHA, which is under the U.S. Department of Labor, was established by Congress in 1970 under the Occupational Safety and Health Act to “save lives and prevent injuries and illnesses in American workplaces.” OSHA has responsibilities for developing standards and regulations, and enforcement. OSHA may set standards on its own initiative or in response to petitions from state and local governments, employers, labor representatives, standards organizations, or any other interested party. If it is decided to develop a standard, any one of several advisory committees may be tasked with the development. The process is very similar to that for other U.S. government agencies, including notice and comment period for interested parties.

28.12 CONTACTING STANDARDS ORGANIZATIONS

There are literally thousands of organizations around the world that are involved in standards development. Today, the World Wide Web (WWW) makes contacting these organizations easier than ever. The following listing is just a small sample of what is out on the Web. Many of the websites listed contain links to the websites of other standards developers.

International**IEC (International Electrotechnical Commission)**

3, rue de Varembe
PO Box 131
CH-1211 Geneva 20
Switzerland
<http://www.iec.ch>

ISO (International Organization for Standardization)

ISO Central Secretariat
1, rue de Varembe
Case postale 56
CH-1211 Geneva 20
Switzerland
<http://www.iso.org>

JTC1 (Joint Technical Committee 1 Information Technology)*

<http://www.jtc1.org>

ITU (International Telecommunication Union)

Place des Nations
CH-1211 Geneva 20
Switzerland
<http://www.itu.ch>

ISOC (Internet Society)

1755 Wiehle Ave.
Suite 102
Reston Va. 20190-5108
U.S.A.
<http://www.isoc.org>
(At this Website the information on the following related Websites can be found.)

IETF (Internet Engineering Task Force)

<http://www.ietf.org>

IESG (Internet Engineering Steering Group)

<http://www.ietf.org/iesg.html>

IAB (Internet Architecture Board)

<http://www.iab.org>

IRTF (Internet Research Task Force)

<http://www.irtf.org>

IANA (Internet Assigned Numbers Authority)

<http://www.iana.org>

CIE (International Commission on Illumination)

Kegelgasse 27
A-1030 Wien (Vienna)
Austria
<http://www.cie.co.at/cie>

Regional Organizations**CEN (European Committee for Standardization)**

Central Secretariat
36, rue de Stassart
B-1050 Brussels, Belgium
<http://www.cenorm.be>

ETSI (European Telecommunications Standards Institute)

650, route des
Lucioles
F-06921 Sophia-Antipolis Cedex France
<http://www.etsi.org>

CENELEC (European Committee for Electrotechnical Standardization)

35, rue de Stassart
B-1050 Brussels
Belgium
<http://www.cenelec.org>

[At this Website a considerable number of contacts are provided for other regional organizations such as the European Computer Manufacturers Association (ECMA), as well as the national standards bodies for member countries such as the Electro-Technical Council of Ireland (ETCI), and affiliate countries.]

*JTC1 is a joint committee of both the ISO and the IEC. The ITU has an official liaison to the committee.

Selected National Organizations*Australia***SA (Standards Australia)**<http://www.standards.org.au>*Canada***CSA (Canadian Standards Association)**

5060 Spectrum Way, Mississauga,

On L4W 5N6

<http://www.csa.ca>**SCC (Standards Council of Canada)**

270 Albert St., Suite 200

Ottawa, ON. K1P 6N7

Canada

CNC/IEC (Canadian National Committee of the IEC)**CNC/ISO (Canadian National Committee of the ISO)**<http://www.scc.ca>*France***UTE (Union Technique de l'Electricité)**<http://www2.ute-fr.com>**TSACC (Telecommunications Standards Advisory Council of Canada)**<http://www.tsacc.ic.gc.ca>**AFNOR (L'Association Française de Normalisation)**<http://www.afnor.fr>*Germany***DIN (German Institute for Standardization)**<http://www2.din.de>**VDE (The Association for Electrical, Electronic and Information Technologies)****DKE (German Commission for Electrical, Electronic and Information Technologies of DIN and VDE)**http://www.vde.com/vde_en*Italy***CEI (Comitato Elettrotecnico Italiano)**<http://www.ceiuni.it>*United Kingdom***BSI (British Standards Institution)****BEC (British Electrotechnical Committee)**<http://www.bsi-global.com>

*United States***ANSI (American National Standards Institute)****USNC (U.S. National Committee of the IEC)**

25 West 43rd Street, 4th Floor
 New York, NY 10036
 U.S.A.

<http://www.ansi.org>

(At this Website a considerable number of links are provided to Websites for standards-developing organizations located in the United States.)

ASC T1 (Accredited Standards Committee T1—Telecommunications)

T1 was retired in 2004 and its work assumed by ATIS.
<http://www.atis.org>

INCITS (International Committee for Information Technology Standards)

formerly Accredited Standards Committee X3 and NCITS.

<http://www.incits.org>

Selected Standards-Developing Organizations**AAMI (Association for the Advancement of Medical Instrumentation)**

<http://www.aami.org>

ABMA (American Bearing Manufacturers Association)

<http://www.abma-dc.org>

AEIC (Association of Edison Illuminating Companies)

<http://www.aeic.org>

AHAM (Association of Home Appliance Manufacturers)

<http://www.aham.org>

AIIM (Association for Information and Image Management-The EMC Association)

(formerly National Microfilm Association)

<http://www.aiim.org>

ANS (American Nuclear Society)

<http://www.ans.org>

API (American Petroleum Institute)

<http://api-ep.api.org>

ARINC (Aeronautical Radio, Inc.)

<http://www.arinc.com>

ASA (Acoustical Society of America)

<http://asa.aip.org>

ASQ (American Society for Quality)

(formerly American Society for Quality Control)

<http://www.asq.org>

ASTM International (formerly American Society for Testing and Materials)

<http://www.astm.org>

ATIS (Alliance for Telecommunications Industry Solutions)

(formerly Exchange Carriers Standards Association)

<http://www.atis.org>

EEI (Edison Electric Institute)

<http://www.eei.org>

EIA (Electronic Industries Alliance)

ECA (Electronic Components, Assemblies, Equipment and Supplies Association)

www.ec-central.org

GEIA (Government Electronics & Information Technology Association)

www.geia.org

JEDEC (JEDEC Solid State Technology Association)

<http://www.jedec.org>

TIA (Telecommunications Industry Association)

<http://www.tiaonline.org>

<http://www.eia.org>

IS Alliance (Internet Security Alliance)

www.isalliance.org

NSTEP (National Science and Technology Education Partnership)

www.nationalstep.org

Electro (Electro-Federation of Canada)

CAMA (Canadian Appliance Manufacturers Association)

CEASA (Canadian Electronic and Appliance Service Association)

CEMC (Consumer Electronics Marketers of Canada)

CEMRA (Canadian Electrical Manufacturers Representative Association)

EEMAC (Electrical Equipment Manufacturers Association of Canada)

MIISC (Medical Imaging and Information Systems Council)

S&D (Supply and Distribution Council)

<http://www.electrofed.com>

IEEE (Institute of Electrical and Electronics Engineers)

<http://www.standards.ieee.org>

IESNA (Illuminating Engineering Society of North America)

(formerly Illuminating Engineering Society)

<http://www.iesna.org>

ISA (The Instrument, Systems and Automation Society)

(formerly Instrument Society of America)

<http://www.isa.org>

IMAPS (International Microelectronics and Packaging Society) (formerly the International Society for Hybrid Microelectronics)

<http://www.imaps.org>

ITI (Information Technology Industry Council)

[formerly Computer and Business Equipment Manufacturers Association (CBEMA)]

<http://www.itic.org>

NACE (NACE International)

(formerly National Society of Corrosion Engineers)

<http://www.nace.org>

NEMA (National Electrical Manufacturers Association)

(includes standards of the Insulated Cable Engineers Association, ICEA)

<http://www.nema.org>

NETA (International Electrical Testing Association)

(formerly National Electrical Testing Association)

<http://www.netaworld.org>

NFPA (National Fire Protection Association)

<http://www.nfpa.org>

SAE (SAE International)

(formerly Society of Automotive Engineers)

<http://www.sae.org>

SEMI (Semiconductor Equipment and Materials International)

<http://wps2a.semi.org>

SMPTE (Society of Motion Picture and Television Engineers)

<http://www.smppte.org>

UL (Underwriters' Laboratories, Inc.)

<http://www.ul.com>

VITA (VMEbus International Trade Association)

<http://www.vita.com>

U.S. Government**CPSC (Consumer Products Safety Commission)**

<http://www.cpsc.gov>

EPA (Environmental Protection Agency)

<http://www.epa.gov>

FCC (Federal Communications Commission)

<http://www.fcc.gov>

FDA (Food and Drug Administration)

<http://www.fda.gov>

FTC (Federal Trade Commission)

<http://www.ftc.gov>

NIST (National Institute of Science and Technology)

<http://www.nist.gov>

NRC (Nuclear Regulatory Commission)

<http://www.nrc.gov>

NTC (National Telecommunications System)

<http://www.ncs.gov>

NTIA (National Telecommunications & Information Administration)

<http://www.ntia.doc.gov>

OSHA (Occupational Safety and Health Administration)

<http://www.osha.gov>

Other Organizations**CITEL (Inter-American Telecommunication Commission)**

Executive Secretariat of CITEL Organization
of American States

1889 F Street NW
Washington, DC 20006
U.S.A.

<http://www.citel.oas.org>

WIPO (World Intellectual Property Organization)

34, chemin des Colombettes
PO Box 18
CH-1211 Geneva 20
Switzerland
<http://www.wipo.int>

WTO (World Trade Organization)

Rue de Lausanne 154
CH-1211 Geneva 21
Switzerland
<http://www.wto.org>

The World Wide Web Consortium (W3C)

In the Americas, contact W3C at:
Massachusetts Institute of Technology
32 Vassar Street, Room 32-G515
Cambridge, MA 02139
USA
<http://www.w3.org>

Webpages of Interest to Those Searching for Standards-Related Information**NSSN (National Standards System Network)**

(a free online information service providing bibliographic information for more than 225,000 approved standards)

<http://www.nssn.org>

WSSN (World Standards Services Network)

(a network of publicly accessible servers of standards associations around the world)

<http://www.wssn.net>

New Approach Standardisation in the Internal Market

(a web site sponsored by CEN, CENELEC, ETSI, the European Commission and EFTA.)

<http://www.newapproach.org>

University of Waterloo—Canada: standards and specifications written by scholarly societies

(provides links to the Internet sites of many standards organizations)

<http://www.lib.uwaterloo.ca/society/standards.html>

U.S. General Services Administration—Index of U.S. Federal Specifications,**Standards and Commercial Items**

(an alpha numerical listing of federal specifications and standards, including a separate listing of all canceled or superseded federal specifications and standards)

<http://apps.fss.gsa.gov/pub/fedspecs/index.cfm>

U.S. Government Printing Office—Federal Register Database

(provides a database for rules, proposed rules, and notices of federal agencies and organizations, as well as Executive Orders and other presidential documents in ASCII or PDF format for 1995 to present (the 1994 federal register is also available, but it has no fields or section identifiers)

<http://www.gpoaccess.gov/fr/index.html>

USNRC Rulemaking Forum

(provides information on the NRC's rulemaking process, current rulemaking information and documents, draft regulatory guides, and NUREGs*)

<http://ruleforum.llnl.gov/index.html>

World Wide Legal Information Association

(provides information on product standards and the law)

<http://www.wwlia.org>

*NUREGs are U.S. Nuclear REGULatory reports normally followed by a number that makes the identification of the NUREG unique, e.g., NUREG 0700 is Guidance for Control Room Design Reviews.

